FLIGHT
The AIRCRAFT ENGINEER & AIRSHIPS

First Aero Weekly in the World.

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

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CONTENTS

DIARY OF FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in the following list :—

Jan. 24 .... **"Fabric and Dopes," by Dr. Ramsbottom, before R.Ae.S.**

Feb. 7 .... **"Airmanship at Sea," by Sqd.-Ldr. Maycock, O.B.E., R.A.F., before R.Ae.S.**

Feb. 21 .... **"Aerial Photography and Survey," by Mr. H. Hamshaw Thomas, before R.Ae.S.**

Mar. 1 .... **French Aero Engine Competition.**

Mar. 6 .... **"Sound Detection," by Major Tucker, before R.Ae.S.**

Mar. 20 .... **"The Report of the Aeronautical Research Committee's Panel on Scale Effect," by Capt. W. S. Farren.**

April 3 .... **"The British Aviation Mission to the Imperial Japanese Navy," by Colonel the Master of Sempill, before R.Ae.S.**

EDITORIAL COMMENT.

LAST week brief reference was made to the new Air Navigation (Consolidation) Order, 1923, which had then just been issued by the Air Ministry and published by H.M. Stationery Office. Time did not allow of a close examination of the Order, and all that was possible was comment on one or two points. This week we publish, on p. 33, a summary of some of the more important items, mainly such as represent changes or innovations in the multitude of rules and regulations with which air navigation is surrounded.

The Air Navigation Order

It might have been thought that the number of certificates, licences, log books, etc., already insisted upon covered the whole field. This does not, however, appear to be the case, and a new log book, to be known as the "journey log book," has now been introduced. In this are to be entered such particulars as will assist the authorities in knowing exactly what took place, and approximately at what point of the route, on any journey made by any aircraft. It may be assumed that the introduction of this new log book has been decided upon to some extent in view of the formation of the new Imperial Air Transport Co. The Air Ministry naturally desires to collect as much information on technical and operational subjects as possible, and the entries in the journey log book of a passenger or goods "flying machine" should assist materially in placing on record any happening or incident which may be of value. In the case of commercial aircraft there is probably no reason to take exception to this innovation, but it would appear that if the carrying—and making of entries "in the prescribed manner"—of journey log books is insisted upon for privately-owned machines, if and when such come to be used in any considerable numbers, the unfortunate owner-pilot will have to spend most of his spare time in chewing the end of his penholder, trying to elicit from its peculiar flavour inspiration for the proper filling up of the log book pages in the approved fashion. Try to imagine the owner of a motor-car being compelled to keep a "journey log book." Yet it would appear to be something very like that which

the Air Ministry now insists upon. It is true that in the case of machines engaged in "joy-riding" an exception has been made, and as a special concession the pilot of such machines may "lump together" the entries on a single page "notwithstanding paragraph 6 of the instructions for use." A privately-owned machine, *i.e.*, one not carrying passengers or goods for hire or reward, is apparently excused from carrying an aircraft log book and an engine log book, but the machine must carry its journey log book, its registration certificate and its airworthiness certificate, while the pilot must, of course, carry his licence. It seems that privately-owned machines are not compelled to be examined by a competent ground engineer before each flight, but the position in this respect is still somewhat vague, and a clear statement would be extremely welcome.

On the somewhat vexed question of airworthiness certificates we are very pleased to note that very material reductions have been made in the fees charged. This applies to all sizes of machines, but perhaps the most important reduction is that in the fee for airworthiness certificates for small machines. Hitherto, it will be remembered, the lowest fee charged was £65. As we have pointed out repeatedly in these columns, this figure imposed an unnecessary hardship on those wishing to build light aeroplanes, and was out of all proportion in the case of machines whose total cost was probably in the neighbourhood of £400 to £500. The lowest fee is now £12 10*s.* for machines whose tare weight does not exceed 500 lbs. This figure is reasonable, and in fact might be said to err on the lenient side, when it is found that for the next larger size of machine, *i.e.*, not exceeding 750 lbs. tare weight, the fee is £25. The jump from £12 10*s.* to £25 seems unnecessarily great, although in a way the difference may be assumed to encourage the smaller machine, as even the lowest figure of 500 lbs. should admit the two-seater light 'plane, while for a tare weight of 750 lbs. quite a reasonably large machine, with fairly powerful engine, could be built. At any rate it is extremely gratifying that all the fees for airworthiness certificates have been lowered, and especially are we glad to find such sweeping reductions in the case of light 'planes. It may be remembered that this subject was first brought into prominence by FLIGHT, and that we have kept hammering away at it ever since the light 'plane was first talked about. The fee for a certificate for a subsequent machine (the larger fee refers, of course, to a so-called "type aircraft," *i.e.*, the first of a new type) is five guineas, as is also the renewal fee, apparently irrespective of size of machine. We do think that if such very great reduction in the original fee for a light 'plane was possible it might have been equally possible to reduce the renewal fee for machines of this type somewhat, say to one guinea. It should be remembered that while the original certificate will be obtained and paid for by the aircraft constructor, the renewal fee will have to be paid for by the purchaser of the machine, and it seems rather inequitable that as much should be paid for the renewal of an airworthiness certificate for a light 'plane as for the largest multi-engined machine in existence. We trust the Air Ministry will be able to announce shortly a revision in the renewal fees for small machines.

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Materials in Aircraft Construction

Commencing with this issue, we are publishing two very important papers read before the Royal Aeronautical Society, dealing with the materials used in aircraft construction. The first paper, by Mr. J. D. North, is published this week, and we hope to publish the second, by Dr. Aitchison, next week. The position as regards obtaining really first-class timber is becoming extremely difficult, and as Mr. North points out in his paper, there are no prospects of improvement. Timber cannot be produced by a wave of the wand, and to wait 20 or 30 years for another "crop" of silver spruce to be grown is, of course, out of the question. Add to this the fact that those who have had most experience—and Mr. North and the firm, Boulton and Paul, Ltd., whose chief engineer he is, occupy a prominent position in British all-metal construction—are most emphatic in their statement that a considerable weight reduction is possible by adopting metal construction, and it will be seen that everything seems to point towards metal construction as inevitable. This is, we believe, fairly generally admitted in the aircraft industry, and many firms, we might even say most firms, are now either wholly going over to metal construction or are gradually substituting metal components for the wood components hitherto used. That being the case, it is essential that a general knowledge of the characteristics and use of various metals should be obtained, and the two papers to which we have referred should help very materially in this respect. For that reason we make no apology for publishing both in full, although the pressure on our space necessitates holding over other matter in order to do so.

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The King's Speech

WE are glad to note that in the Speech from the Throne, on January 15, His Majesty confirmed the determination to strengthen our Home Defence Air Force and stated that proposals would be submitted for the expansion of the Royal Air Force in connection with Home Defence.

Duke of Sutherland Returns

HIS GRACE THE DUKE OF SUTHERLAND, Under-Secretary of State for Air, has now returned from his visit to the United States, and in an interview with press representatives gave his impressions of American aviation. To summarise, His Grace considered that as regards naval and military aviation the two nations were about equal, although certain of their types were faster than ours, and held the world's speed records. In the matter of airships the Duke of Sutherland considered that the United States were far ahead of us. The use of helium gas was an advantage, but helium was very expensive to manufacture and transport, and he was not sure that it could be made available for commercial use. At present the gas was being transported from Texas (where the gas is found in considerable quantities) to New Jersey (where the airship sheds are based) in metal cylinders.

On the subject of commercial aviation the Duke of Sutherland considered that we were far ahead of America, where at present there was no federal legislation governing the licensing of machines and pilots. His Grace was, however, impressed by the American Air Mail, and referred to the chain of beacons being established at 25 miles' interval across the Continent so as to extend the utility of the air mail by making night flying possible.

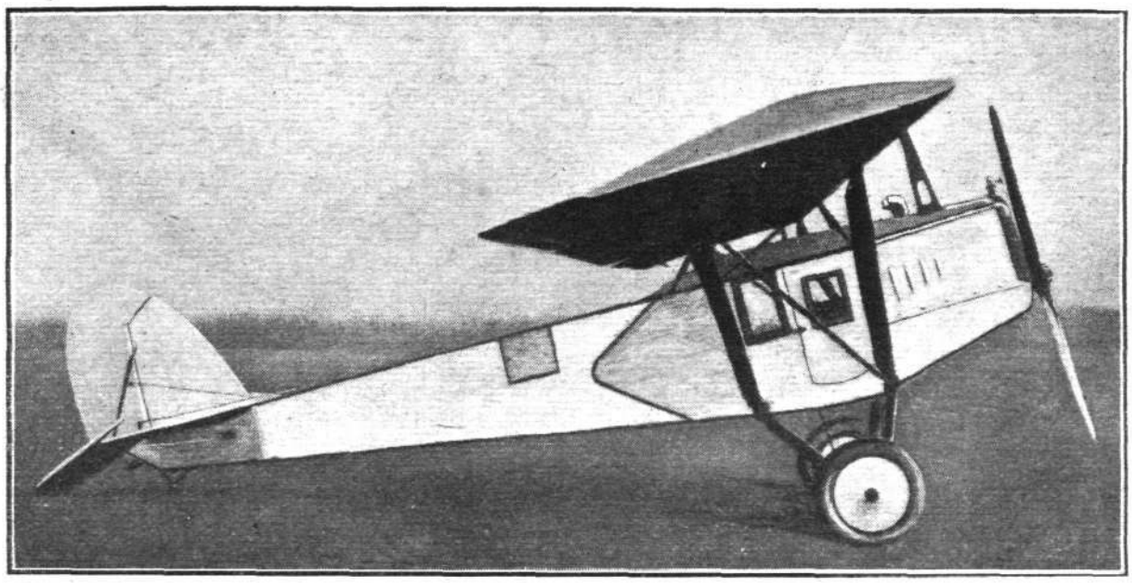
Speaking about the American airship Shenandoah, the Duke of Sutherland stated that it was the intention of the American Government to carry out a Polar expedition by airship. Two steamships equipped with mooring masts and supplies of helium and petrol would be sent to Alaska and to Spitzbergen. The Shenandoah would fly first to Alaska, and from there would commence its flight across the Polar regions to Spitzbergen. If this flight was successful the airship would probably fly to Pulham, Norfolk, in order to give British people an opportunity of viewing it.

FLIGHT

THE STAHLWERK-MARK R.V/23 COMMERCIAL MONOPLANE

A New German Machine Carrying Four Occupants on a 100 h.p. Mercédès Engine

REFERENCE has been made on various occasions to the Inter-Allied restrictions on German aircraft design, which limit the size of machine and engine that it is permissible to build and operate in Germany. The result has been, on the one hand, that German designers, impatient of the fetters, have gone abroad and there established factories, such as the Rohrback factory in Denmark, and the Heinkel works in Sweden, or else have perforce had to be content with producing machines of such size and power as come within the limits imposed. Quite a crop of low-power machines have consequently been built, most of which have been described and illustrated in FLIGHT from time to time. At the Gothenburg Aero Show were exhibited two single-seaters designed by Herr Rieseler and built by the Stahlwerk-Mark aircraft section. These were fitted with Haacke engines of 30 h.p., and bore the series numbers R.III. A two-seater of very similar design is known as the type R.IV. Now the same firm has produced a monoplane four-seater, the R.V., which, as it was built in 1923, is identified by the works numbers R.V/23. This machine forms the subject of our photographs and scale drawings this week.

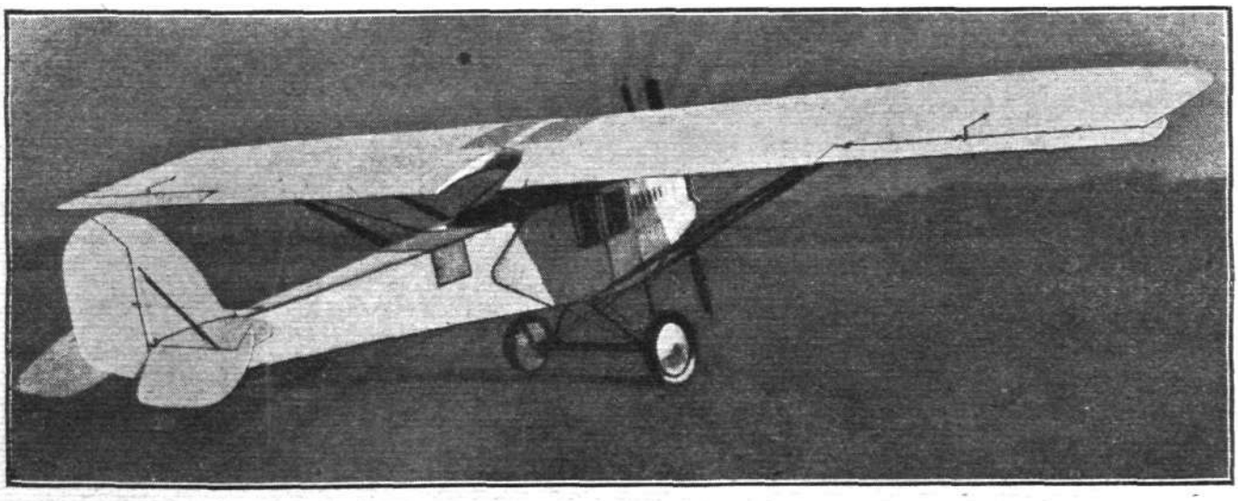


THE MARK R.V/23 MONOPLANE: Side view

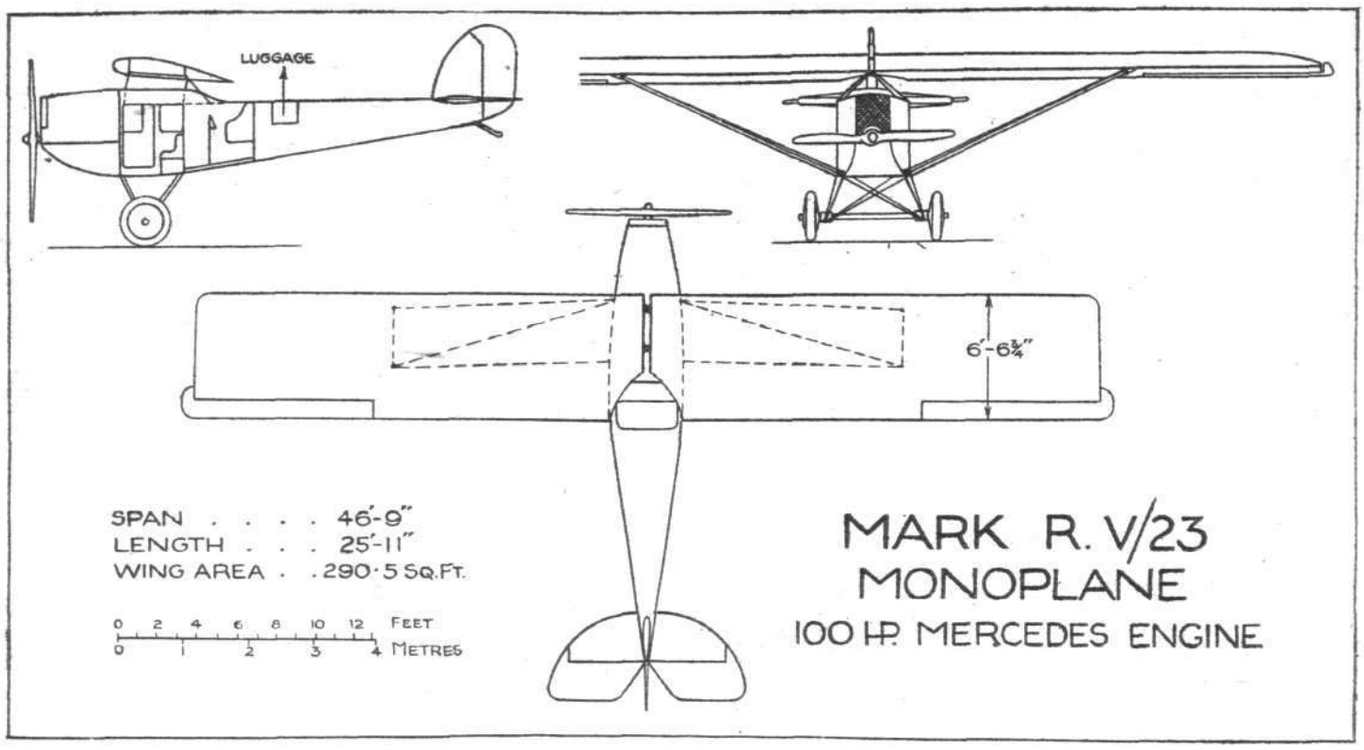
As in the case of the R.III and R.IV Stahlwerk-Mark machines, the R.V/23 is a parasol monoplane, with the divided wing carried on a steel tube trestle rising from the top of the fuselage. The two wing-halves are supported by long steel tube struts running to the lower longerons. Thus, although a fairly deep wing section is used, the machine is not a cantilever monoplane. The lift struts, it will be seen, meet the wings a long way out towards the tips. In fact the overhang is of considerably smaller span than is the inner portion of the spars. The fuselage is of rectangular section, and a large flat nose radiator rather spoils the lines of the fuselage forward. Nevertheless, the machine appears to be very efficient, as it is carrying four occupants on 100 h.p. at a speed of 93 m.p.h. The design is a plain straightforward job, and the main objects aimed at by the designer were, apart from efficiency and economy, cheapness of production and ease of replacements and repairs.

The fuselage is a welded steel tube structure, cross-braced with wire, and fabric covered over the aft portion. Forward the covering is aluminium. The 100 h.p. 6-cylinder-in-line Mercédès engine is mounted on a steel tube structure. The sides of the engine compartment are covered with an aluminium bonnet which can be raised as in a motor-car, thus giving ready access to every part of the engine. A fireproof bulkhead forms the rear wall of the engine housing, and separates it from the passengers' compartment.

The cabin in the R.V/23 has accommodation for but two passengers, seated side by side and facing forward. The third passenger is placed next to the pilot in the open cockpit aft



THE MARK R.V/23 MONOPLANE: Three-quarter Rear view.



STAHLWERK-MARK R.V/23 MONOPLANE: General arrangement drawings.

of the cabin. We understand, however, that in the production type the cabin will be extended to include the third passenger. The headroom in the cabin is not very great, being little more than just sufficient to allow the passengers to sit upright, and it is not possible for them to stretch themselves during the journey. Windows in the sides of the cabin and in the door provide sufficient light, and the cabin is heated in winter by hot air from the engine, ventilators in the roof allowing of regulating the temperature. The controls consist of a foot bar for the rudder and wheel mounted on a column for the ailerons and elevator. Behind the pilot's cockpit is a small compartment for luggage.

The wing of the R.V/23 is of normal construction, with two wooden spars and wooden ribs. It is built in two halves, attached at the centre to a steel tube *cabane* and braced by sloping struts to the bottom of the fuselage. By undoing eight quick-release bolts the wing can be dismantled, an operation requiring but a very short time. The ailerons are balanced, and are of high aspect ratio. The tail is of orthodox design, and rudder as well as elevator are balanced. The tail members are made of welded steel tubing and fabric covered. The undercarriage is a simple V-type of steel tubes, with the axle sprung by rubber cord.

The petrol system is of the simple gravity type, the petrol tanks being mounted in the wing, near the *cabane*. The tank capacity is sufficient for four hours at full speed, giving a range, in still air, of 370 miles.

The main characteristics of the Stahlwerk-Mark R.V/23 are as follows: Length o.a., 7·9 m. (25 ft. 11 ins.); Span, 14·25 m. (46 ft. 9 ins.); Chord, 2 m. (6 ft. 6¾ ins.); Wing area, 27 sq. m. (290½ sq. ft.); the weight of the machine (empty) is 800 kgs. (1,760 lbs.); the useful load is 480 kgs. (1,055 lbs.) composed as follows: 1 pilot, 3 passengers, fuel for 4 hours, and 110 lbs. of luggage; the total loaded weight is 1,280 kgs. (2,815 lbs.) giving a wing loading of 9·7 lbs./sq. ft. The power loading is 28·15 lbs./h.p. It is stated that the maximum speed is 150 kms. (93 m.p.h.), and that the climb, with full load, to 1,000 m. (3,300 ft.) occupies eight minutes. We have no figures relating to the stalling speed, but in view of the high wing loading this must be somewhat high, although a high-lift wing section is used. When the experimental machine was tested at Breslau, it is stated to have exceeded the expectations of the designer, Herr Rieseler, and after a few minor modifications it will probably be put into production. As a taxiplane, the machine should be very economical to operate, and over relatively short distances the somewhat cramped passenger accommodation might not greatly matter.

CORRESPONDENCE

CHINESE AIR POST

[2084] With reference to the paragraph in the Air Post Stamps article in FLIGHT of October 25, it may interest you to know that there has never been a *regular* air post service in this chaotic country, despite the stamps so grandiloquently issued. The service "resumed on May 22, 1922," to which you refer, was operated merely spasmodically during the summer of 1922 between Peking, Tientsin, and the European seaside resort of Peitaiho; perhaps a dozen or so journeys all told.

It was loudly boomed to be started again this year (1923), and air mail stamps were officially on sale at the post offices. Actually the "service" was even more of a fiasco than last year, not half a dozen trips being made. This is due, not to lack of foreign support, nor to any incompetence of the foreign pilots employed, nor defect in the machines (Vicker's Vimys), but solely to the deplorable condition of the Administrative Government of China; the money which should go to the operation of a regular mail service, the upkeep of machines, and the salaries of pilots and mechanics being diverted into sundry fat officials' and politicians' pockets instead. No service could possibly be operated under the conditions prevalent in China at present, though under a responsible and efficient government there are immense possibilities in this direction—North China, except perhaps during the semi-arctic winter months, being ideal for aeroplanes; and Central China being particularly adapted for amphibian work. The attempts of the Chinese to operate an air service leave those of us who are old flying officers and take an interest in flying bereft of suitable language to express our feelings!

Before I close I might mention that quantities of the air post stamps (not such an anachronism after all, for Peitaiho is but a score of miles from the Great Wall) have been printed; and that, though not officially on sale at the post offices except during the summer of 1922 and July-August, 1923, they are unofficially obtainable at any time, and in any quantity.

Tientsin. J. S.

FORMATION OF LIGHT 'PLANE AND GLIDER CLUB

[2085] A number of enthusiasts have under consideration the formation of a Light 'Plane and Glider Club near London for persons (flying and non-flying) interested in the movement. Will, therefore, all readers who are interested kindly send their names and addresses to Mr. Preston, c/o 36, Great Queen Street, Kingsway, W.C.2, so that, as soon as sufficient names have been received, it will be possible to call a meeting of those interested to discuss proposals and matters relating to the formation of the suggested Club?

Knightsbridge, S.W.7. R. PRESTON.

FLIGHT

THE AIR NAVIGATION (CONSOLIDATION) ORDER, 1923

As briefly recorded last week, the Air Navigation (Consolidation) Order, 1923, has just been issued, and is obtainable from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, price 1*s*. net. The order came into effect, on January 1, and sets forth all the rules and regulations that have to be observed in the registration, licensing and operation of aircraft, and personnel. Generally speaking, few alterations have been made since the issue of the previous (amended) order. In one or two instances, however, changes have been made, and certain new rules have been added.

The order applies to all British aircraft registered in Great Britain and Northern Ireland, wherever such aircraft may be and to foreign aircraft when over Great Britain and Northern Ireland. As hitherto, an aircraft being flown for experimental purposes within three miles of a licensed aerodrome is not compelled to bear the usual identification and registration marks, nor to have been certified as airworthy, nor to carry the usual log-books and other documents. The personnel, however, must be provided with the prescribed certificates, but in the case of a registered machine the personnel is exempt from the certificate restriction if they are undergoing official flying tests for a certificate, and are flying within a radius of three miles from an aerodrome.

Foreign aircraft shall not fly over Great Britain and Northern Ireland unless the aircraft possess the nationality of a State having signed the International Air Convention, an exception being made in the case of Spain, Switzerland, Norway, Sweden, Denmark, the Netherlands, Finland, Esthonia, Latvia and Monaco, and of certain States which have signed but have not ratified the Convention

In the future a passenger aircraft carrying more than ten passengers and having to make a continuous flight between two points more than 310 miles apart over land, or a night flight, or a flight between two points more than 124 miles apart over sea, shall have on board a licensed navigator. The general safety provisions of the Order deal with such precautions as are deemed necessary to ensure safety, such as trick flying over towns, regattas, race meetings, etc., and it is laid down that smoking is prohibited in any aircraft registered in Great Britain and Northern Ireland wherever such aircraft may be, and in any other aircraft when in or over Great Britain and Northern Ireland.

The Order includes eight schedules, dealing with the following subjects: I, registration and marking of aircraft; II, certificates of airworthiness for aircraft, periodical overhaul and examination, detention of unairworthy aircraft; III, log books; IV, rules as to lights and signals and rules of the air; V, licensing of personnel; VI, fees; VII, prohibited areas; VIII, customs rules.

It is not proposed to go into great detail here concerning the various rulings, as those interested should obtain a copy of the Order, but certain new features of general interest may be mentioned. With reference to certificates of airworthiness, it is laid down that the certificate for a "type aircraft" shall have effect as a certificate for the particular machine, and be subject to renewal, but that the certificate shall still continue as a valid certificate for the type (as distinct from the specimen).

Fees

A new scale of charges for airworthiness certificates has been established, which is, generally speaking, much lower than those previously in force. When the tare weight does not exceed 500 lbs. the fee for a certificate of airworthiness for a type aircraft is £12 10*s*. For 750 lbs. weight it is £25; for 1,000 lbs., £30; for 1,500 lbs., £35; for 2,000 lbs., £40; for 3,000 lbs., £44; for 4,500 lbs., £50; for 6,000 lbs., £56; for 8,000 lbs., £64; for 10,000 lbs., £72; for 12,500 lbs., £80, and for each additional 2,500 lbs., £7 10*s*. These figures relate to type aircraft. If, however, application is made for an airworthiness certificate for a type aircraft which so far resembles an existing type aircraft, in respect of which a certificate has already been issued, as to reduce materially the work involved in carrying out the investigations, calculations, tests and inspections necessary, the fee chargeable shall be reduced by such an amount as is, in the opinion of the Secretary of State for Air, proportionate to such reduction. The fee for a subsequent aircraft belonging to a type for which the type certificate has been issued is £5 5*s*., as is also the renewal fee for any airworthiness certificate. The registration fee is £1 1*s*., and for renewal of registration 5*s*. is charged.

The fees charged on the issue of aerodrome licences vary according to distance from nearest R.A.F. station. When this distance is not more than 25 miles the fee is £1 1*s*.; when more than 25 miles but not more than 50 miles the fee is £2 2*s*., and above 50 miles the fee is £3 3*s*. The renewal fee, in all cases, is £1 1*s*. No mention is, apparently, made in the Order of landing fees for aircraft at licensed aerodromes, but it is stated that in every aerodrome licensed for public use, or which is open to aircraft upon payment of charges, "there shall be a single tariff of charges, including charges for landing and length of stay, applicable alike to British and foreign aircraft, and such tariff shall be in such form and on such a scale as may be directed or approved by the Secretary of State, and shall be kept exhibited in a conspicuous place at the aerodrome."

In the case of licences to personnel the following charges are made for the issue of a licence: medical examination, £1 1*s*.; technical examination, 5*s*.; flying test, £1 1*s*.; licence, 5*s*. Where the application is for renewal of licence the charges are the same, except for the medical examination, for which a fee of 10*s*. 6*d*. is charged. The fee chargeable for the validation of a licence granted by the duly competent authority in a foreign State to a navigator, engineer, or pilot is 5*s*.

The usual proofs of competency and medical fitness are required from applicants for a pilot's licence to fly passenger and goods aircraft, and applicants for licences to fly aircraft other than aircraft carrying passengers or goods for hire and reward "will be required to produce such proofs of competency, medical fitness, and recent reasonable flying experience as may be prescribed, or, failing such proof of recent reasonable flying experience, he may be required to undergo practical tests."

Log Books

In addition to the usual regulations as to log books, etc., a new form of log book is now demanded, known as the "journey log book." The price of a journey log book has been fixed at 4*s*., and it is stated in Air Navigations Directions 3B that "applications for the issue of journey log books should be made, accompanied by the prescribed fee, to the Secretary (D.C.A.), Air Ministry, London, W.C. 2. Such books will be issued only in respect of individual aircraft. The first page of each book will be completed by the Air Ministry before issue." The aircraft log books, engine log books, and pilot's log books are, of course, obtainable from H.M. Stationery Office as hitherto. The journey log book of a commercial aircraft need not contain fully detailed entries unless the machine carries a navigator. In all cases, however, sufficient information must be entered to enable the route followed by the aircraft to be clearly identified. In Air Navigation Directions, 1924 (A.N.D. 3B), it is laid down, evidently with a view to facilitate and condense entries in the journey log books of aircraft being used for "joy-riding," that "when an aircraft is engaged in a number of flights upon the same day on all of which the aircraft returns to the point of departure after a flight of less than thirty minutes, entries in respect of the whole of such flights may, notwithstanding paragraph 6 of the Instructions for Use, be included on a single page of the journey log book. In that event the actual number of flights so included shall be shown, together with the total duration of the flights, the total time the engines have been run on the ground, and the total number of passengers carried." It is also laid down that entries in the journey log books and pilot's log book shall be made at latest within 24 hours after the events to which they relate.

The rest of the Air Navigation (Consolidation) Order, 1923, contains very detailed particulars under the various schedules outlined above, and in addition an annex H of the Convention, known as schedule IX, dealing with general customs provisions.

According to the section dealing with the interpretation of the Order, "aircraft" now means all classes of machines, whether heavier or lighter than air, while the term "flying machine" has been officially adopted to indicate aeroplanes, seaplanes and flying boats, or other aircraft heavier than air and having means of propulsion.

LIGHT 'PLANE AND GLIDER NOTES

Those wishing to get in touch with others interested in matters relating to gliding and the construction of gliders are invited to write to the Editor of FLIGHT, *who will be pleased to publish such communications on this page, in order to bring together those who would like to co-operate, either in forming gliding clubs or in private collaboration.*

ON January 10 it was announced that the amount of the Air Ministry Prizes to be offered in connection with the competition to be held this year for two-seater light 'planes will be £3,000. In view of the relatively low cost of light 'planes, this amount appears sufficiently substantial to ensure that a comprehensive entries list shall be secured, and that really useful two-seaters of low power shall be evolved. A good deal still depends upon the regulations that are to govern the competition, but if these are wisely planned the amount of money offered should be capable of really doing good. It may be assumed that other prizes will be forthcoming, although it seems to us questionable whether it would not be wiser to keep the competition for the Air Ministry Prizes entirely separate, and to offer any subsequent additional prizes for other performances.

* * *

IT will be remembered that so far but the briefest outline of the aims and objects of the competition has been published. It is known that the machines must be two-seaters, must be fitted with engines not exceeding 1,100 c.c. capacity, and must be provided with dual controls. From this it is evident that the Air Ministry desires to evolve a type of machine that may be used for training purposes, the dual controls being stipulated with that object in view, while the small engine capacity should tend towards keeping the type low in first cost and upkeep, and at the same time sufficiently efficient to have a reasonably good performance. It will now be up to the racing committee of the Royal Aero Club to draft, in collaboration, presumably, with representatives of the Air Ministry, such rules as shall produce the "best" type of machine.

A BELGIAN LIGHT 'PLANE: The Cambier monoplane has a thin-section, wire-braced monoplane wing, and is fitted with a 16 h.p. Sergant engine. Three-quarter front view. Standing in front of the machine are M. Rooms, the pilot, and M. Cambier, the constructor.

* * *

To begin with, it is essential that the rules should be drawn up with the least possible interference from the Air Ministry. While it is true that "he who pays the piper calls the tune," we are quite certain that if aircraft manufacturers are left a free hand to produce machines which, in their opinion, are likely to prove useful for the purpose for which they are designed, the resulting types will be far better than if all sorts of restrictions were imposed, tying the hands of designers and putting an effective check on originality. In the case of large machines intended for military purposes, it may be necessary to impose all sorts of official restrictions. For

The Cambier Monoplane: M. Rooms in the pilot's cockpit.

light 'planes it is certainly neither necessary nor desirable. There is no doubt whatever that the unqualified success of last year's competitions at Lympne was to a very great extent due to the total absence of official restrictions. If such restrictions can be eliminated, or at any rate kept down to the minimum, again this year, we are quite confident that really fine machines will be produced. In fact, beyond the stipulation concerning dual controls and 1,100 c.c. engine capacity, there would not appear to be any need for further official interference. Unless there is some clause in the offer, relating to the purchase of winning machines, it would seem that the Air Ministry is free to purchase, after the competitions, any type that is considered suitable without necessarily being restricted to place orders for types that have done well in the competitions. (We are, of course, assuming that orders will be placed.) It is quite conceivable that the best all-round machine may not do particularly well in the tests, but may be of the greatest general utility for all that.

* * *

IT is important that the rules be drawn up with an idea of encouraging general qualities rather than outstanding merits on any one particular point. Last year the cry was economy, and but for the secondary prizes offered, economy would have been the only feature aimed at. This must not occur this year, although, naturally, the question of economy must be taken into account. The limit on engine capacity should, however, ensure sufficient economy without any special mileage being stipulated.

* * *

SPEED range, angle of climb, taking off and landing are believed to be among the objects to be aimed at in drafting the rules. Regularity and reliability are also worth encouraging, and Hinkler's performance on the Blackburne-engined AVRO light monoplane last year showed what can be done by a persevering pilot, even under very bad weather conditions. It would be well to place importance on the amount of flying done during the competitions.

WITH regard to the locality of the competitions, this has not yet been announced. There is a feeling in some quarters that as the competition is to be more or less an official affair, Lympne is as suitable as anywhere. On the other hand, one of the London aerodromes would be preferable as enabling visitors to go and watch the flying. Last year's meeting was by way of being an experiment. Now, however, there is little doubt about what the light 'plane can and cannot do, and there is, we think, no reason why the public should not be admitted to the meeting. Open country around the aerodrome, and a suitable route for the "lapping," are the main requirements, and both Stag Lane and Hendon should be eligible on that score. Croydon, with the enormous traffic which the million-pound monopoly company may be expected to be organising by next summer, is probably less suitable. A good triangular course could, probably, be mapped out with Hendon, Stag Lane and Bittacy Hill as the turning points.

* * *

FROM one of our many esteemed friends in Belgium we have received the accompanying photographs, and a few brief particulars, of the Cambier light monoplane. M. Cambier, who is *chef d'exploitation* of the S.A.B.E.N.A., is also an amateur designer and constructor. The Cambier is an orthodox monoplane, with thin-section wings braced by piano wire. The fuselage is covered with three-ply. The engine fitted is a 16 h.p. Sergant, similar to that with which the Poncelet and Peyret monoplanes at Lympne were fitted.

* * *

THE Cambier monoplane has made several flights, piloted by M. Rooms. On one occasion the machine reached an altitude of 2,000 m. The main dimensions are : Length o.a., 6 m. (19 ft. 7 ins.) ; span, 10·2 m. (33 ft. 5 ins.) ; area, 13·5 sq. m. (145 sq. ft.). The weight empty, but with fuel, is 200 kgs. (440 lbs.), and the maximum speed approximately 65 m.p.h.

HOME DEFENCE EXPANSION

400 Officers for Flying Duties

THE Air Ministry announced on Jan. 3 that the Royal Air Force was prepared to engage, during the current year, approximately 400 officers for flying duties, under the short-service commission scheme, and applications are accordingly invited immediately from suitable candidates. Nearly 350 of these are required as a result of the authorised expansion of the Air Force for home defence, the remainder being needed to replace officers who automatically pass to the Reserve of Air Force Officers on termination of their period of engagement. With this addition, the total number of short-service officers engaged on flying duties will be about 1,400.

Candidates, who should be of good education but who need not have had any previous flying experience, must not be less than 18 and not more than 29 years of age at the time of entry. They will be interviewed by a Selection Committee, and those selected, after passing the standard R.A.F. medical examination, will be gazetted as pilot officers, on probation. The probationary period is six months, after which, subject to satisfactory progress, officers are confirmed in rank.

Short-service commissions are granted for five years' service on the active list, followed by a period of four years' service on the Reserve.

For all purposes of pay, allowances, and promotion, short-service officers receive equal treatment with officers holding permanent commissions. The present rates of pay and allowances for unmarried pilot officers amount to £1 5*s.* 10*d.* per day, or about £471 per annum. In addition, short-service officers receive on transfer to the Reserve on the termination of their period of regular service, a gratuity of £75 per annum, or a sum of £375 for the whole period of service on the active list. When they are transferred to the Reserve they receive retaining fees and are required to undergo short periods of flying training each year on up-to-date war-type aircraft.

Pilot officers will be posted to one of the Royal Air Force flying training schools, where they will undergo a course of training in aviation and in aeronautical, military, and technical subjects for a period of about a year. At the end of this period they will be posted to an Air Force squadron for duty. Pilot officers, subject to satisfactory progress having been made, will be promoted to flying officers, with increased rates of pay, after completing 18 to 21 months' service from the date of being gazetted as pilot officers.

A limited number of officers serving on short-service commissions may be selected for transfer to the permanent list, and officers so selected will be allowed to count their actual service on their short-service commissions towards retired pay or gratuity under the permanent officers' scales, but will not be eligible for the gratuity of £75 a year mentioned above.

All officers entered under this scheme are taught to fly, and special facilities are afforded to study certain other subjects, and especially to enable them to qualify for the A.M.I.M.E. Arrangements have also been made for all officers, who desire it, to receive special tuition from the R.A.F. educational officers, who have been recently appointed, to equip themselves for civil life against the time when their period of service terminates. It is hoped during the next few years greatly to extend these educational facilities.

Application forms and copies of the detailed regulations can be obtained by applying in writing to the Secretary, Air Ministry, Adastral House, Kingsway, London, W.C. 2.

On January 8 the Air Ministry announced that sufficient enquiries for application forms have been received at present. When the present enquiries have been dealt with a further announcement will, if necessary, be made.

It was also announced recently that approximately 200 pilots were required for flying duties in the Air Force Reserve of Officers, and, in this case, further applications to join the Reserve are desired from those who served as pilots in the flying services during the war or who hold civil licences to fly commercial aircraft, particularly from ex-pilots residing in Scotland or in the counties north of the Trent.

Fatal Accident at Isle of Grain

ON January 15 Flight Lieut. W. R. Curtis and Squad. Ldr. S. M. Cleverley met with a fatal accident whilst carrying out an experimental flight on a Bristol machine at the Isle of Grain Air Station. They had been flying for some time when the machine suddenly crashed to the ground. The pilot, Flight Lieut. Curtis, died almost immediately, and his passenger shortly afterwards. Squad. Ldr. Cleverley was a member of the staff of the Director of Research at the Air Ministry.

MATERIALS IN AIRCRAFT CONSTRUCTION

By J. D. NORTH, F.R.Ae.S., and LESLIE AITCHISON, D.Met., B.Sc., F.I.C.

[AN unusually interesting and instructive paper was read before the Royal Aeronautical Society on January 10. The paper, which was in two sections, will be published in full in FLIGHT, as it deals with a subject of the greatest possible importance to the whole future development of aircraft construction, *i.e.*, "Materials Used in Aircraft Construction." The first section, by Mr. J. D. North, is published below, while the second part, by Dr. Leslie Aitchison, will be published next week.—ED.]

AN immediate increase of the valuable supplies of silver spruce is hardly within the capacity of man, and since it has been found that metal can with advantage be used in the place of first-quality silver spruce and *a fortiori* in place of its inferior substitutes, I propose to discuss metals only in these notes.

The problem of structural design in aeroplanes possesses many unique features which are not to be found among those of ordinary engineering structures. By this I do not mean to say that the fundamental theory of structures is in any way modified in its application to aircraft, but rather that the peculiar conditions to be fulfilled bring into prominence various points which, in ordinary civil engineering, are so readily smoothed over as practically to escape notice. I need scarcely remind anyone here that in no other form of structure does weight economy so amply repay the engineer. It is true that in certain cases, such as crane jibs, the importance of light structure is recognised, but no designer of hoisting machinery has thought fit to go to the lengths which are accepted as ordinary aeroplane practice in order to obtain lightness.

Just as weight economy reimburses the aeroplane designer, so there is a heavy penalty for failure to achieve a light structure. The useful load capacity of the aeroplane is within such a narrow margin of the gross weight that the intrinsically heavy aeroplane is always at a grave disadvantage. Commander Hunsaker suggested, in his Wilbur Wright Memorial Lecture before the Royal Aeronautical Society, that the preliminary weight estimate of an aeroplane should be regarded as a bank account which under no circumstances must be overdrawn. This is a precept which I would heartily endorse, but the practice is scarcely easier structurally than it is financially.

Weight breeds weight, and it is no uncommon event for a completed aeroplane to be as much as 5 per cent. in excess of its estimated gross weight, and the structure has to be strengthened to withstand the extra load; thus more weight is added, and so the pernicious cycle continues.

In order to solve the problem of design of light structural members for the aeroplane we must utilise the following means of approach: Firstly, we must know the external forces on the aeroplane which have to be withstood; secondly, we must find the loads in the various members produced by these forces; thirdly, we must devise forms and select materials for these members in order that they may perform their duty with a minimum weight expenditure. This form of approach rather suggests that the arrangement of the various members is predetermined, and while this is not actually true, we do not approach the problem of structural design with an absolutely open mind as to the general arrangement of the machine. As in all creative engineering work, the arrangement adopted by the designer is chosen to meet, in his general opinion, the various requirements of the finished aeroplane. The vast number of variables renders impossible a complete analytical attack on the problem of the general arrangement, and it is for this reason that theoretical structural knowledge is no substitute for experience. As every engineer knows, he can, within the limits of his experience, intuitively appreciate the various points which arise in preliminary design, and the analytical method is applied at a later stage to verify his intuition and to extract the last ounce which is to be saved by refinement of design. It is the importance of this ounce that gives such an impetus to the analysis of structural problems in aircraft design and the development of new machines, and ways and means have been evolved which are unnecessary in general engineering practice, where they give no adequate return for the labour involved.

Since, from a structural point of view, the special quality of the aeroplane is its lightness, it would appear obvious that those materials which would make the greatest appeal to the aeronautical engineer will result in the lightest structure, but an examination of the modern aeroplane shows a general use of materials which do not satisfy this requirement.

To a very large extent I believe this to be due to the precedents of pre-War practice, which under war conditions crystallised into standards, on which the efforts of manufacturers could most conveniently be concentrated.

In a previous paper* before the Society I discussed some methods whereby very substantial saving could be effected in the structure weight of an aeroplane. By the use of proper materials in *all* parts of the aeroplane this saving could be considerably augmented. We have to consider whether, in adopting these new materials and methods of manufacture, we are on sound metallurgical grounds, a point which is dealt with by Dr. Aitchison in the other part of this paper; secondly, we must consider how manufacturing costs will be affected.

I feel that this latter aspect of the case has not been viewed in the proper light. It is, I think, generally admitted that our present experience has shown us that this saving of weight can be realised, but I do not feel that its full significance is understood.

Let us examine as an example a case of a high-performance medium-range day-bomber, one of the most important classes of offensive aircraft. A machine of this class should be able to protect itself by reason of its performance and manœuvring powers against defensive attack from enemy aircraft without the assistance of an escort. The performance necessary can only be realised with a power loading of about 10 lbs. per horse-power, and fuel must be carried for four hours' flight at full speed at ground level.

Supposing a fair representative value for the structure weight of the "standard construction" aeroplane of this class to be 36 per cent. An examination of figures for aeroplanes made of wood, mild steel and so on convinces me that this is a reasonable figure for aeroplanes between 7,000 lbs. and 12,000 lbs. gross weight of this type of manufacture. The 10 lbs. carried by each horse-power will then be made up as follows:—

Engine	2 lbs.
Fuel	2 ,,
Engine installation, *i.e.*, tanks, propeller, exhaust pipes, fuel pipes, water system, &c., of standard type	1 lb.
Structure	3·6 lbs.
Military load	1·4 ,,
Total	10 lbs.

The military load is thus 14 per cent. of the gross weight of the aeroplane. By introducing light alloys into the fuel system, by special construction of tanks and so on, it should be possible to reduce the item for installation to 0·8 lb. We can already with confidence say that the use of high-tensile steels and light alloys will reduce the structure item to 2·7 lbs. The balance will now be as follows:—

Engine	2 lbs.
Fuel	2 ,,
Installation	0·8 lb.
Structure	2·7 lbs.
Military load	2·5 ,,
Total	10 lbs.

The military load is now 25 per cent. of the gross weight. Suppose that the military load is required to be 2,000 lbs., the weights of the two aeroplanes to fulfil precisely the same functions so far as performance, range, and carrying capacity are concerned will be roughly 14,000 lbs. and 8,000 lbs. respectively. They may be appropriately pictured as, in the first case, a biplane 80-ft. span with two Rolls-Royce Condor engines, and in the second case a biplane 60-ft. span with two Bristol Jupiters.

To consider first the question of prime cost, a very fair figure for the cost of aeroplanes of standard construction is 15*s.* per lb. of gross weight, not including the cost of engine or military equipment, instruments, etc., while a reasonable average figure for the cost of aeroplane engines is £4 per h.p. The cost of the first aeroplane as influenced by gross weight

* "The Case for Metal Construction," *Aeronautical Journal*, January, 1923.

i.e., excluding cost of equipment, will therefore be as follows:—

	£	s.	d.
Engine, 1 h.p.	4	0	0
Aeroplane, 10 lbs. at 15*s.* per lb.	7	10	0
Total cost per h.p.	11	10	0
Gross h.p. 1,400, gross cost	16,000	0	0

I have used round numbers in the arithmetic, but have everywhere under-estimated rather than over-estimated the cost.

Now let us turn to the second machine. The 800 h.p. at £4 per h.p. will cost £3,200, and deducting this from the £16,000 (the gross cost of the first machine) we are left with £12,800 for the aeroplane structure, representing a figure of £1 12*s.* per lb. of gross weight of the aeroplane. That is to say, the cost per lb. of gross weight can be *more than doubled* without making the prime cost of the aeroplane to fulfil a specific duty any higher than it would be for the standard construction. Manufactured in moderate quantities, the difference in cost per unit weight is nothing like as great as this, and there is no doubt whatever that the lighter type will be very much cheaper in prime cost. The effective working of the materials necessary to achieve this light structure requires a more elaborate engineering organisation, more extensive and more expensive plant, and also a considerable amount of tool-making, die-sinking for drop stampings, etc., all of which are in the nature of a fixed standing charge of constant amount very nearly independent of output and consequently a rapidly diminishing percentage on cost as the output for a given type increases.

The advantage does not, however, end with prime cost. The cost of engine maintenance where 400 h.p. engines are used instead of 700 h.p. is greatly diminished, while the larger aeroplane has a fuel bill 75 per cent. greater than the smaller. Handling, shed accommodation, transport are all simplified, and a very large saving in operating cost *for the same service* is indicated.

From a military point of view there is the further tremendous advantage of greater manœuvrability in favour of the smaller machine. With standard ratio of control force to hinge moment, *i.e.*, with similar balancing, the relative time taken by two similar machines of different size to execute a given manœuvre varies as the square of their linear dimensions. In other words, the time taken by the larger machine to execute a manœuvre will be 75 per cent. greater than in the case of the smaller machine. This difference of manœuvrability is so great that in all probability the larger machine could no longer be considered to come within the class of self-defending aircraft. It will, of course, be noticed that the magnitude of the advantage in favour of light construction is emphasised by the large proportion of the permissible weight per horse-power represented by the engine, fuel and installation. The constant efforts to increase performance and range in military aircraft are likely to increase this figure in the future rather than to reduce it. It is thus evident that even apart from the saving in prime cost and running cost an air force equipped with aeroplanes of the heavier type of construction is likely to be at a hopeless military disadvantage against a force armed with the lighter type of machine.

In the case of commercial aircraft, where the power loading rises to 15 or 16 lbs. per horse-power the advantage of the lighter type of construction is, of course, not so startling. It will probably be correct to say that the prime cost for a given service would be about the same in both cases, the advantage being gained in reduced running expenses.

Similar arguments can of course be applied to the design of equipment. On the type of military aeroplane which has just been considered the prime cost of aeroplane and engine of "standard construction" is £8 per lb. weight of military load. Therefore every ounce saved in equipment means a saving of 10*s.* worth of aeroplane, which has not only to be bought but maintained.

With the lighter type of aeroplane construction this saving will probably represent about 6*s.* or 7*s.* an ounce. An examination of standard military equipment is sufficient evidence that this point of view is not appreciated by those responsible.

If I have demonstrated that it is worth while using the best possible materials to give the lightest structure, I can now turn to consider what these materials are. The principal structural parts of an aeroplane may be grouped under the heading of ties and laterally-loaded struts. I have already discussed in a previous paper* the methods of construction and the materials, by the use of which these members may be made as light as possible. In order to find a basis for the discussion of the physical properties of materials suitable for these members, we must remember that an aeroplane is primarily designed on the failure strength of its members. Although an aeroplane is a redundant structure, the standard method enforced for calculating the loads in the members ignores many redundances, and calculations, except in very special cases, are based solely on the maximum load the member is capable of taking. Where redundances exist the straining of members beyond the limits of proportionality, which may occur at moderate loads (*e.g.*, flexure of struts) gives a distribution of loads throughout the structure, which is distinctly removed from that which would be calculated by the usual "strain energy" method, and in most cases this straining has the effect of distributing the loads in a more favourable manner. The increase in real strength of the aeroplane on this account is considered in determining the load factors.

* Ibid.

Ties.

Within the limits described above the only property of ties from the point of view of static strength which need be considered is the ultimate tensile strength. The ratio of elastic limit to ultimate must, of course, be such that, with the load factors used, the members are not liable to be permanently deformed under ordinary service conditions. The ultimate tensile strength of materials will be referred to in the rest of these notes as F_t.

Laterally-Loaded Struts.

The determining property of the material is the value of E, and of E_t (the slope of the stress-strain diagram) at the failing stress on the compression stress-strain curve. This is based on the assumption that as strain is released the stress falls according to the value of E. This has been found to be true for many materials, but it may not be strictly so for all, in which case two values of E_t (on the upward curve, and on the downward curve) for the stress in question are required. Yield point, in materials which possess it, is the point of failure for a considerable range of lengths of any given strut, but this is really a particular case of the general result.

An attempt has been made to define the critical stress in compression, as the stress at which some definite small plastic extension takes place, in which case it has been called the proof stress. It is very doubtful if this method is accurate, and for the purposes of these notes I shall refer to the critical compressive stress as F_c.

Apart from possessing properties favourable to these strength requirements, materials must be able to be worked commercially, and they must have adequate ductility to avoid the formation of stress cracks, and similar failures due to the inability of the material to adapt itself to highly-concentrated local stress. A fairly wide range of steels meets these conditions in varying degrees, and it is possible that there is a wide range of light alloys which will also satisfy our requirements, but experience in this latter direction is limited to one or two well-known alloys.

Table I.

	Bar.	Sheet & Strip.	Tube.
Low carbon	—	S.3	T.6 T.22
Medium carbon	S.1	—	T.2 T.5
Medium tensile alloy ..	S.2	S.43	—
High tensile alloy	—	S.40	—
Very high tensile alloy ..	—	—	T.2

Steels

Table I shows the various classes of steel with different conditions of manufacture, which are in use or are specially suitable for aeroplane construction. Where B.E.S.A. specifications exist they have been indicated. The low carbon group in the normalised state only gives F_t 18 tons per sq. in. and F_t 26 tons per sq. in. These can be brought up to F_t 28 and F_t 32 by cold work. The very low specific strength of these materials makes them uneconomical structurally.

The medium carbon group in the normalised state will give an F_t of about 35 tons per sq. in., and when cold-worked an F_t of 35 to 40 tons per sq. in. In this latter state they are merging into the medium tensile alloy steel group with F_t 40 to 50 tons per sq. in., F_t 50 to 55 tons per sq. in. As the alloy steels are brought up to strength by hardening and tempering, and not by cold work, they are obviously more suitable for working up into plate fittings. Experience has shown that medium tensile alloy steels with an F_t of about 50 tons per sq. in. are very suitable for making fittings and represent a saving of nearly 50 per cent. in weight on the normalised low carbon sheets. Alloy steel bar with an F_t of 55 tons per sq. in. is similarly an economical substitute for medium carbon bar, the extra difficulty of machining this

class of material being to a large extent compensated for by the smaller amount of material which has to be removed. These two materials seem to represent an excellent compromise between ductility and strength, and it is scarcely practicable to use steels for fittings with a higher tensile strength; in fact, a slight reduction, say, 10 per cent., in the value of F_t of S.2 will be advantageous if a definite gain in machining qualities is to be expected. The high tensile alloy steel, F_t 65 to 75 tons per sq. in., F_t about 80 tons per sq. in., can only be worked satisfactorily in very thin material, *e.g.*, under 22 G. on account of its low ductility. It is probable also that the very thin material is not liable to stress and crack owing to its elastic instability, causing the material to buckle rather than crack. There is a distinct use for solid-drawn tubes having these mechanical properties, and such a material can be obtained by tempering down the very high tensile alloy steel tubing T.2, which is commonly used for axles. In addition to the above, medium carbon steel rods are rolled or swaged into Raf wires and tie-rods, a very large amount of cold work put into the material bringing the F_t up to 60 tons per sq. in.

Fairly frequent fatigue failures in Raf-wires in service naturally make the material worthy of special consideration, but owing to the manufacturing difficulties involved, I believe that no more favourable proposition has been put forward.

Joining Processes.

The use of alloy steel sheets for built-up fittings immediately raises the question of joining processes. Autogenous welding is, of course, excluded by the nature of the material, and I understand that the metallurgist considers this to be good riddance to bad rubbish. Brazing, particularly dip-brazing, is attractive, since it can be incorporated in the heat-treatment programme, but personal experience of the formation of cracks (whether due to stress or inter-crystalline penetration seems uncertain) have made me very cautious of using this process for alloy steels. Certain precautions have been suggested for carrying out the process, and these seem to have led to satisfactory results, though, naturally, satisfactory results are of a negative nature, and require to be very extensive to be convincing. In the meantime riveting and sweating have been utilised successfully, and found to meet every requirement. The function of the sweating is primarily to relieve riveting or pinning at joints from fluctuating stress, though one would imagine that as a joining process sweating alone, when properly carried out, is at least as reliable as glue in wood-joining.

The use of high tensile steel bar for bolts and nuts requires a reconsideration of the range of sizes which are to be used. Steps of $\frac{1}{16}$ in. in diameter are too coarse, and as—thanks to the initiative of the Royal Aircraft Factory—the aircraft industry was many years ago robbed of the international standard metric system, we are compelled to fall back on the British standard fine thread in stages of $\frac{1}{32}$ in., and on the bastard offspring of the British Association for sizes under $\frac{7}{32}$ in.

Light Alloys.

Duralumin, the best known of the light alloys, gives an F_c of about 15 tons per sq. in., and an F_t of 25 tons per sq. in. Specifically, its strength is of the same order as the medium tensile alloy steels, and it may be usefully considered as a convenient substitute for very thin steel sheet avoiding the difficulties of instability, etc., which would be found with a material less than 0.01 in. thick. 20 G. duralumin sheet is roughly equivalent to 30 G. steel sheet. Duralumin is particularly suitable for torsion tubes in control surfaces where the question of rigidity makes it necessary to use the large diameters, while the very low stress would bring the appropriate thicknesses of steel into the region where failure by buckling takes place at a low load. Duralumin may also be used with advantage to form an extension on the lower scale of bolt sizes, particularly for joining duralumin to duralumin and for equipment installation.

Drop Stampings.

With the use of high-grade materials drop stampings for joints must be available to the designer. Only in a very few cases is it possible to make a reasonably light joint with a steel stamping unless it is possible to machine it all over; these are the cases where the surplus material necessary for the purposes of draw can be removed. I recall vividly the manufacture of the frame joints of the "R.E.7" aeroplane, where, owing to the designer of the joints having failed to consider this fact, the joints came out greatly in excess of their estimated weight, and large numbers of gunsmiths had to be employed to chip off the surplus material. With light alloy stampings, owing to the greater finished thickness of the part, the difficulty of the draw is not so acute, and I think that stampings of this material will in the future play an important part in aircraft construction. The fine dimensions of the finished part in any material, however, make it necessary for the greatest care to be taken to register the dies accurately and to maintain a uniform thickness of flash.

Engine Installation.

The extensive use of copper and brass in the fuel system, and of tinned mild steel sheet in tanks, offers great opportunity for weight economy by the substitution of better materials. The extended introduction of duralumin for cocks, connections and duralumin or aluminium for the pipes in the water, fuel and oil systems seems inevitable. Tinned mild steel sheet for tanks might with advantage be replaced by stainless iron or a nickel-copper alloy such as Monel or Corronil metal with improvement from a strength and weight point of view, and the reduction, if not elimination, of the constant corrosion troubles due to the difficulty of getting away chlorides from the soldering fluxes. Aluminium or light alloy tanks depend for their success on a petrol-tight joining process—a problem which cannot be considered to have been wholly solved.

Exhaust pipes, the thickness of which is largely governed by the question of scaling, can be made of thinner material if stainless iron, Monel or Corronil metal, or some other metal which does not oxidise readily at high temperatures, is employed. Such manifolds, experience has shown me, are very satisfactory.

Objection has been raised by certain people to the use of high-quality materials on the grounds that they will be abused by those who are charged with the maintenance of the aeroplane on service. This I believe to be a most improper way to regard an engineering matter. There is nothing whatever in the use of such materials which will prevent the skilled artisan, the semi-skilled workman or the labourer from carrying out their ordinary duties of maintenance satisfactorily provided they are under proper engineering supervision. An engineering training cannot be acquired as part of a two-years' college course, and the work of the maintenance engineer is essentially a whole-time job. I do not believe that any attempt to run a large flying organisation, either service or civil, can be really successful unless the engineering work of maintenance is carried out directly under the supervision of professional engineers. I do not advocate the use of hundred-ton steels or excessively-cold-worked ultra-light alloys, but rather materials which by their nature are best in consideration of strength, lightness and reliability, and which by their fundamental properties can be so treated that they reach down to our requirements rather than materials of inferior quality which must strain up to them.

Lawrence B. Sperry's Body Found

THE body of Lawrence B. Sperry, the American aviator who mysteriously fell into the English Channel on his aeroplane on December 13 last, was recovered on the shore, near Rye Harbour, on January 11. At the inquest, held at Broom Hill on January 14, the body was identified by Mr. Percy Jackson, managing director of the Sperry Gyroscope Co. The jury brought in a verdict of "Found drowned."

"Dixmude" Wreckage Found

THE French torpedo-boat *Barbara* has been engaged in searching for the wreckage of the lost "Dixmude" in the neighbourhood of Cape San Marco on the south-west coast of Sicily, and as a result of the dragging operations a number of articles said to belong to the "Dixmude" have been recovered. These consist of a complete airship valve, some electrical fittings and portions of clothing. The discovery of these articles supports the theory that the "Dixmude" was destroyed by fire—probably having been struck by lightning—and fell into the sea off Sciacca, in which vicinity the commander's body was recovered.

Memorial to Sir Ross Smith

COMPETITIVE designs are invited by Mr. E. A. Anstey, Hon. Sec., Alexandra Chambers, Grenfell Street, Adelaide, for a statue in bronze, and pedestal (to cost approximately £5,000), in honour of the late Sir Ross Smith, K.B.E. Designs may be submitted up to September 30, 1924. It is believed that it is intended to set up the memorial in Adelaide, Sir Ross Smith's native city. For full particulars apply to the Agent-General for South Australia, Australia House, London.

FLIGHT

THE ROYAL AIR FORCE

London Gazette, January 8, 1924

General Duties Branch

H. C. Evans is granted a permanent commn. as Pilot Offr. with effect from Dec. 20, 1923, and with seny. of Dec. 20, 1922.

The following are granted short service commns. in the ranks stated, with effect from and with seny. of the dates indicated :—*Flying Offrs. (for Seven Years on the Active List).*—N. C. Bretherton (Lieut., I.A., retd.), R. K. Emerson (Lieut., I.A., retd.), H. W. A. Fox (Lieut., R.N., retd.), R. W. M. Hall (Capt., I.A., retd.), J. V. Kelly (Lieut., R.F.A., retd.), T. B. R. Meadimore (Capt., I.A., retd.), R. G. Peckover (Lieut., I.A., retd.), R. W. Pilling (Lieut., I.A., retd.), H. G. Radcliff (Lieut., I.A., retd.), E. H. D. Spence (Lieut., R.N., retd.), L. P. Winters (Capt., I.A., retd.), F. W. Wiseman-Clarke (Lieut., R.N., retd.) ; Jan. 3. *Pilot Offrs. on Probation (for Five Years on the Active List).*—W. C. Adams, W. C. Barnsley, W. J. Brett, L. A. Bull, F. E. R. Dixon, M.C., J. J. FitzGerald, S. E. Hall, B. F. H. Harding, R. W. Holden, R. O. Jones, H. T. Messenger, F. E. North, C. J. Pavia, G. M. Pitts-Tucker, J. E. Preston, H. W. Raeburn, M. Russell, G. A. Simons, H. G. Slater, F. T. Stacey, H. Thomas, A. D. B. Trevor ; Jan. 3. W. Wynter-Morgan, M.C. ; Jan. 4. H. R. V. Fowler is granted a short service commn. as a Flying Offr., with effect from, and with seny. of, Dec. 29, 1923.

The following Lieuts. are granted temp. commns. as Flying Offrs. on seconding for four years' duty with the R.A.F. :—R. Legg (K.O.S.B.), C. Lloyd (The Buffs) ; Jan. 3. J. Messer-Bennetts (K.O.S.B.) ; Jan. 4. Flying Offr. A. B. Ellwood, D.S.C., is placed on half-pay, Scale B, from Jan. 1 to Jan. 31, inclusive. Flying Offr. A. C. Clinton is transferred to Reserve, Class B ; Aug. 14, 1923 (substituted for *Gazette*, Aug. 14, 1923). Flying Offr. E .G. King is transferred to Reserve, Class C ; Nov. 22, 1922 (substituted for *Gazette*, Nov. 21, 1922). Flying Offr. A. Maybaum resigns his short service commn. ; Jan. 1. Flying Offr. J. E. R. Hyson relinquishes his short service commn. on account of ill-health, and is permitted to retain his rank ; Jan. 2.

Reserve of Air Force Officers.

J. Ward is granted a commn. in Class A, General Duties Branch, as Pilot Offr. on probn. ; Jan. 8. Flying Offr. W. C. Pruden is transferred from Class A to Class C ; April 26, 1923. Flying Offr. C. V. Frith resigns his commn. ; Dec. 10, 1923.

The commns. of the following officers are terminated on cessation of duty, with effect from the dates indicated :—*Flying Offr. on Probn.*—F. M. Ll. Barr ; Nov. 8, 1923. *Pilot Offrs. on Probn.*—R. A. Jacquot ; Dec. 8, 1923. G. E. Lavin ; Nov. 21, 1923 ; S. S. Rackowe ; Dec. 8, 1923. A. J. Stubbings ; Oct. 14, 1923.

The following officers are confirmed in rank, with effect from dates indicated : —*Flying Offrs.*—R. M. Clifford ; Nov. 8, 1923 ; H. J. Ellam ; Dec. 16, 1923. C. G. Kitchingman, R. D. de L. Miller ; Dec. 19, 1923. G. A. Ogg ; Dec. 26, 1923. *Pilot Offrs.*—L. J. Tripp ; Dec.18, 1923. D. W. S. Ireland, M. B. Lacey, R. N. Riddell, J. Simpson ; Dec. 26, 1923.

Memorandum.

Lieut. J. B. E. Crosbee, Worc. R., is granted rank of Capt., R.A.F., on resigning his Army commn. ; Dec. 8, 1923.

ROYAL AIR FORCE INTELLIGENCE

Appointments.—*The following appointments in the Royal Air Force are notified :—*

General Duties Branch

Wing Commanders : A. H. E. Wynn, O.B.E., to No. 7 Group H.Q., Andover, for Air Staff duties. 14.1.24. J. T. Babington, D.S.O., to No. 3 Group H.Q., Spittlegate, for Air Staff. duties 14.1.24.

Squadron Leaders : P. C. Sherren, M.C., to Aeroplane Experimental Estabt., Martlesham Heath. 21.1.24. H. V. Champion de Crespigny, M.C., D.F.C., and A. W. F. Glenny, M.C., D.F.C., both to R.A.F. Depot on transfer to Home Estabt. 17.12.23.

Flight Lieutenants : P. Huskinson, M.C., to No. 5 Wing H.Q., Biggin Hill. 11.1.24. E. J. Cooper, D.S.C., to Marine and Armament Experimental Estabt., Isle of Grain. 11.1.24. V. H. Tait, to Air Ministry. 16.1.24. F. Wright, to Armament and Gunnery Sch., Eastchurch. 14.1.24. A. L. Fiddament, D.F.C., and K. A. Lister-Kaye, both to R.A.F. Depot on transfer to Home Estabt. 17.12.23. H. A. Smith, M.C., to No. 39 Sqdn., Spittlegate. 14.1.24. J. A. Boret, M.C., D.F.C., to No. 32 Sqdn., Kenley, instead of to No. 100 Sqdn., as previously notified. 14.1.24.

Flying Officers : A. P. White, to No. 1 Sch. of Tech. Training (Boys). Halton. 11.1.24. R. B. Harnden, to Marine and Armament Experimental Estabt., Isle of Grain. 11.1.24. J. A. McDonald, to No. 4 Sqdn., South Farnborough. 7.1.24. S. J. Mason, to R.A.F. Depot on transfer to Home Estabt. 28.11.23. J. Messer-Bennetts, to R.A.F. Depot, on appointment to a Temp. Commn. on being seconded from the Army. 4.1.24.

The following Flying Officers are all posted to the R.A.F. Depot, on appointment to Short Service Commns. (3.1.24) :—N. C. Bretherton, F. W. Wiseman-Clarke, R. K. Emerson, H. W. A. Fox, R. W. M. Hall, J. V. Kelly, T. B. R. Meadmore, R. G. Peckover, R. W. Pilling, H. G. Radcliff, E. H. D. Spence, and L. P. Winters. R. Legg and C. Lloyd, both to R.A.F. Depot, on appointment to Temp. Commns. on being seconded from the Army. 3.1.24. B. C. W. Windle, D.F.C., to Sch. of Tech. Training (Men), Manston. 14.1.24. E. T. St. M. Brett and A. H. J. Howlett, both to R.A.F. Depot on appointment to Short Service Commns. 9.1.24.

Pilot Officers : The following Pilot Officers are all posted to the R.A.F. Depot, on appointment to Short Service Commns. (on probation) (3.1.24) :—W. C. Adams, W. C. Barnsley, W. J. Brett, L. A. Bull, F. E. R. Dixon, M.C., J. J. Fitzgerald, S. E. Hall, B. F. H. Harding, R. W. Holden, R. O. Jones, H. T. Messenger, F. E. North, C. J. Pavia, J. E. Preston, H. W. Raeburn, M. Russell, G. A. Simons, H. G. Slater, F. T. Stacey, H. Thomas, A. D. B. Trevor, and G. M. Pitts-Tucker. W. Wynter-Morgan, M.C., to R.A.F. Depot, on appointment to a Short Service Commn. (on probation). 4.1.24.

The following Pilot Officers are all posted, with effect from 19.12.23, on appointment to Permanent Commns. from R.A.F. (Cadet) College, Cranwell :—G. C. A. Armstrong and J. H. Hutchinson, both to No. 56 Sqdn., Biggin Hill. H. R. F. Baxter, E. S. C. Davis, and E. A. McKinley-Hay, all to No. 7 Sqdn., Bircham Newton. F. W. L. C. Beaumont and L. W. Dickens, both to No. 207 Sqdn., Eastchurch. C. C. Edwards and J. E. G. H. Thomas, both to No. 111 Sqdn., Duxford. J. L. F. Fuller-Good and W. C. Ward, both to No. 11 Sqdn. Bircham Newton. H. M. Groves, C. W. Moss, M. D. Ommanney, and R. R. Reedman, all to Sch. of Army Co-operation, Old Sarum. R. B. H. Jackson, to No. 32 Sqdn., Kenley. N. W. F. Mason and W. J. P. Sloan, both to No. 39 Sqdn., Spittlegate. N. Young, to R.A.F. Base, Leuchars.

Stores and Accountant Branch

Squadron Leaders : C. L. Archbold, to No. 1 Stores Depot, Kidbrooke. 14.1.24. W. Millett, to No. 3 Stores Depot, Milton. 14.1.24.

Flying Officers : A. P. Woollett, to No. 4 Stores Depot, Ruislip. 14.1.24. R. W. L. Glenn (Accountant), to No. 4 Flying Training Sch., Egypt. 11.1.24.

Medical Branch

Flight Lieutenants : A. F. Rook, M.R.C.P., D.P.H., to R.A.F. Hospital, Cranwell. 14.1.24. T. M. Walker, to Palestine General Hospital. 21.10.23. F. E. Johnson, to H.Q., Iraq. 5.12.23. J. A. Quin, M.D., B.A., to No. 14 Sqdn., Palestine. 16.11.23. (Hon. Sq. Ldr.) A. G. Lovett-Campbell, M.B., to R.A.F. Depot (Non-effective Pool) on transfer to Home Estabt. 25.12.23.

Flying Officers : F. K. Wilson, M.B., to Research Lab. and Medical Officers' Sch. of Instruction, Hampstead, for short course. 2.1.24. W. J. Hutchinson, M.B., to R.A.F. Hospital, Cranwell. 18.1.24. R. W. White, to R.A.F. Central Hospital, Finchley. 14.1.24.

Chaplains' Branch

Rev. J. H. P. Still, B.A., to Basrah Group H.Q., instead of to H.Q., Iraq, as previously notified. 23.11.23.

Royal Air Force (Cadet) College

The following is a list of Cadets who successfully completed in December, 1923, their course of training at the Royal Air Force (Cadet) College, Cranwell :—G. C. A. Armstrong (winner of Sword of Honour and R. M. Groves Memorial Prize), H. R. F. Baxter, F. W. L. C. Beaumont, E. S. C. Davis, L. W. Dickens, C. C. Edwards, J. L. F. Fuller-Good, H. M. Groves, J. H. Hutchinson, R. B. H. Jackson, N. W. F. Mason, E. A. McKinley-Hay, C. W. Moss, M. D. Ommanney, R. R. Reedman, W. J. P. Sloan, J. E. G. H. Thomas, W. Ward, and N. Young (winner of Abdy Gerrard Fellowes Memorial Prize).

PERSONALS

To be Married

The marriage of Flight-Lieut. FREDERIC HOPE LAURENCE, M.C., R.A.F., younger son of Mr. and Mrs. Gerard Laurence, of Corrie Wood, Letchworth, Herts, and Marjorie Vera (Daidie), only surviving child of Mr. J. B. Rawlinson, Graythwaite Old Hall, Ulverston, Lancs, and Mrs. Rawlinson, 35, South Street, Park Lane, W., will take place in Bombay in February.

ROYAL AERONAUTICAL SOCIETY

Election of Members

The following Members have recently been elected :—

Fellow : Major H. N. Wylie.

Associate Fellows : Mr. F. T. Courtney, Mr. S. H. Evans, Captain A. B. Fanstone, A.F.C., Flight-Lieut. R. A. de H. Haig, Mr. E. C. Hubbard, Mr. P. A. Ralli, Mr. A. P. Rowe, Mr. P. H. Watson, and Mr. J. D. Williams.

Students : Mr. R. Vasconcellos de Aboim, Mr. L. G Brazier, Mr. G. A. Chamberlain, Mr. F F. Crocombe, Mr. F. J. W. Wingfield Digby, Mr. C. E. T. Maguire, Mr. H. A. Miles, Mr. G. Ponsonby, Mr. C. H. Pridham, Mr. W. T. Sandford, Mr. H. C. de M. Seaman, Mr. S. W. Slaughter, and Mr. F. Small.

Temporary Honorary Foreign Member : Lieut. S. Kato, I.J.N.

Associate Members : Mr. A. E. Heatley, Mr. R. L. Preston, Squadron Leader G. W. Robarts, M.C., Mr. R. A. Tarleton.

Foreign Members : Mr. W. G. Brown, Mr. P. Guilonard, Mr. J. L. Merrill, Mr. Y. Motomura, and Mr. S. A. U. Rasmussen.

Scottish Branch.—Members : Mr. B. H. Alexander and Captain A. Kingmill.

Lecture.—The next fortnightly meeting of the Society will take place at 5.30 p.m. in the Theatre of the Royal Society of Arts, John Street, Adelphi, W.C.2, on January 24, when Dr. J. E. Ramsbottom of the Royal Aircraft Establishment, will read a paper on "Dopes and Fabrics."

Journal.—The January number of the Journal of the Royal Aeronautical Society, which is on sale, price 2*s.* 6*d.* to non-members, contains the following :—"Some Recent Developments in Aircraft Instruments," by Major H. E. Wimperis, O.B.E., F.R.Ae.S., and "The Practical Difficulties of Commercial Flying," by Mr. F. T. Courtney, A.F.R.Ae.S.

W. LOCKWOOD MARSH,
Secretary.

BY DOUGLAS B. ARMSTRONG

New Czecho-Slovak Issue

NEW air-post stamps are heralded from Czecho-Slovakia in connection with the daily aerial mail service between Prague and Prezburg, which has been in operation since October 29th, 1923. They are to be of a definitive character, their face values being fixed at 10, 20 and 30 hellers respectively. Presumably, they will be printed in the long-promised design, showing an aeroplane encircling the "Hradschin" Citadel at Prague.

The first Czecho-Slovak aero stamps were issued on September 15th, 1920, coincident with the inauguration of a regular bi-weekly flying post between Paris and Prague, as well as from Prague to Warsaw. Special stamps were provided in denominations 14, 24 and 28 krones, representing the supplementary fees upon air-borne letters to Warsaw, Paris and through to London respectively. These were improvised by overprinting a crudely-executed aeroplane, together with the new value in abbreviated form, between two propellers, upon regular postage stamps of the 1919 series, with a vignette of the "Hradschin"; in red, black or blue. In the first instance, they were issued imperforate, but a second printing placed on sale in the following March was perforated 13½. Errors exist surcharged on the wrong values, whilst the 28 kr. on 1,000 heller is known with the over-print inverted. On the suspension of the Paris-Prague service in October, 1921, these stamps were withdrawn from circulation. It was resumed in March, 1922, when for a time ordinary postage stamps were employed, and cancelled with a special postmark in violet ink, inscribed "Letecka Posta—Post Aérienne."

The present issue of air-post stamps, surcharged on the "Art and Industry" stamps of 1920, was brought into use on May 15, 1922, in anticipation of the establishment of the Prague-Vienna-Budapest air line, which, however, did not actually commence operations until two months later. The overprint is similar to that of the first issue, except that the two propellers are so disposed as to obliterate the original figures of value, and the surcharges are in terms of "heller" instead of krones, viz., 50/100 heller, green; 100/200 heller, violet; 250/400 heller, brown.

Roumanian Irregulars

AT a London stamp auction last month, £3 was paid for two sets of Roumanian stamps, purporting to have been used for air postage, but surrounding which there is an element of mystery. Roumanian postage stamps overprinted "P.A.R." (Posta Aeriena Romana) and "Posta Aeriena 1920" were first heard of towards the end of that year, when they were alleged to have been issued by the Roumanian post office on the occasion of the extension of the trans-Continental air line to Bucharest. A circumstantial story was circulated to the effect that only 500 sets of either series had been printed. Inquiries on the spot, however, revealed the issue to have been an entirely unauthorised experiment on the part of an aviator more enterprising than honest, so that the stamps in question have always been regarded with suspicion by air post collectors.

Air Stamps from Ecuador

THERE does not appear to be any published record of an air-post service operating in the Central American Republic of Ecuador, although it is not unlikely that experimental postal flights may have taken place there at one time or another. This supposition is prompted by the fact that the existence of a hitherto unrecorded set of Ecuadorian stamps overprinted with the device of an aeroplane in red has recently been brought to the writer's notice. Can any reader of FLIGHT throw light upon this mysterious issue?

SOCIETY OF MODEL AERONAUTICAL ENGINEERS

ANNUAL General Meeting will be held on Thursday, January 31, in the British Empire Room, Central Y.M.C.A., Tottenham Court Road, W.C. 1, at 7.30 p.m. Nominations should be received by the Hon. Secretary on or before the first post Thursday, January 24, 1924. Members are requested to take special notice of general rule No. 5.

News has just come to hand that Mr. Tucker of Dulwich College was experimenting with a large glider, 10 ft. span, at Streatham, getting some interesting results.

Mr. L. Lansdown, of the B.H.A.C., has been getting some glides from a new glider of over two minutes' duration.

It is to be hoped to publish fuller details later.

A. E. JONES, Hon. Sec.

48, Narcissus Road,
West Hampstead, N.W. 6.

IMPORTS AND EXPORTS, 1922-1923

AEROPLANES, airships, balloons and parts thereof (not shown separately before 1910). For 1910 and 1911 figures see "FLIGHT" for January 25, 1912; for 1912 and 1913, see "FLIGHT" for January 17, 1914; for 1914, see "FLIGHT" for January 15, 1915; for 1915, see "FLIGHT" for January 13, 1916; for 1916, see "FLIGHT" for January 11, 1917; for 1917, see "FLIGHT" for January 24, 1918; for 1918, see "FLIGHT" for January 16, 1919; for 1919, see "FLIGHT" for January 22, 1920; for 1920, see "FLIGHT" for January 13, 1921; for 1921, see "FLIGHT" for January 19, 1922; and for 1922 see "FLIGHT" for January 18, 1923.

	Imports		Exports		Re-Exports	
	1922.	1923.	1922.	1923.	1922.	1923.
	£	£	£	£	£	£
Jan. ..	1,152	466	76,552	60,079	23	280
Feb. ..	567	641	69,129	120,236	1,100	3,040
Mar. ..	1,471	589	166,607	71,945	100	689
April ..	3,846	8,508	139,995	167,757	5,880	462
May ..	2,416	845	167,999	55,427	4,254	728
June ..	816	1,433	129,137	141,381	14,530	1,410
July ..	1,039	192	24,405	62,025	—	1,334
Aug. ..	198	2,054	88,910	57,704	685	344
Sept. ..	3,043	578	71,508	39,069	44	106
Oct. ..	633	705	40,225	80,002	90	8,272
Nov. ..	52	1,246	203,437	55,001	450	250
Dec. ..	245	918	159,657	97,295	—	108
	15,478	18,175	1,336,617	1,007,921	27,156	17,023

AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations: cyl. = cylinder; I.C. = internal combustion; m. = motor

The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

APPLIED FOR IN 1922

Published January 10, 1924

19,127. R. E. MITTON. Controlling-mechanism for flying machines. (208,184.)

24,673. R. E. CARY and E. A. KITE. Lifting and propelling means for aircraft. (208,215.)

24,794. RAUL, MARQUIS OF PATERAS PESCARA. Aerial transport apparatus. (208,220.)

24,945. SOC. RATEAU. Means for heating accommodation for crew and passengers in aircraft. (186,331.)

29,529. SOC. ANON. DES ATELIERS D'AVIATION L. BREGUET. Protecting device for fuel tanks. (188,649.)

34,566. ARMSTRONG-SIDDELEY MOTORS, LTD., and F. M. GREEN. Framework for aircraft. (208,381.)

APPLIED FOR IN 1923

Published January 10, 1924

8,626. A. GRILLI. Screw propellers. (208,462.)

11,548. R. MCFARLANE. Device for straining wire, etc. (208,474.)

FLIGHT

The Aircraft Engineer and Airships

36, GREAT QUEEN STREET, KINGSWAY, W.C. 2.
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